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HOUSEHOLD-ARTS ARITHMETIC

KATHARINE F. BALL

Minneapolis, Minnesota

MIRIAM E. WEST

Plainfield, New Jersey

Unlike many courses in mathematics, the course in household-arts arithmetic which the writers have been teaching in the Plainfield high school makes no pretension of considering arithmetic an end in itself. No attempt has been made to include all the arithmetical principles and processes that have received the sanction of custom. The problems have not been chosen primarily because they served to illustrate some phase of arithmetic. The material has not been arranged with reference to the mathematical order of topics. Yet the course is distinctly a course in arithmetic, not in household arts; it involves the use of those principles and processes which are usually considered important, and the topics are arranged in logical order. More than this, the course is based upon principles which the writers believe to be in harmony with modern educational ideals.

In the first place, the course has been designed to meet the needs of a particular group, namely, girls from twelve to sixteen years old in the junior high school, the daughters of wage-earning and small-salaried men in urban communities. These families belong economically to the middle class. They are above the level of a struggle for mere existence; they are below the level of luxury and idleness. In these families, although there may occasionally be servants, the daughters are expected to participate in household duties. The mothers may have sewing machines; the homes may be equipped with gas and electricity; carpets or rugs cover the floors; curtains hang at the windows; there may even be a vacuum cleaner to lighten the burden of housecleaning. Yet the pressure of necessity is so sharp that, as a rule, every

dollar must be used to its utmost if the social efficiency of the family is to be maintained. Some girls will leave school at the close of the compulsory period, not always because of dire necessity, but in order to lighten the family burden.

For this group of girls an intelligent understanding of the economic aspect of homemaking is a matter of immediate concern. They are having first-hand experience with one of the most important social problems, and they know that sacrifices have to be made and economies have to be practiced in order to keep the children clothed, fed, and in school. This fund of experience can be made an educational asset if it can be drawn upon in a way that is adapted to the interests and capacities of these young girls. Actual homemaking is at least several years ahead. For that reason this is not the time to give them a vocational course in the sense of specific training for assuming the responsibilities of managing the home, but it is a suitable time to broaden their general education. The problems of the home furnish a means of achieving this result. The course may be said to have a threefold aim:

1. To enable the girls to understand and appreciate the economic problems in their own homes.
2. To make them skilful in the computations and methods of reasoning involved in everyday affairs, so that arithmetic may become a tool in effective living.
3. To make them able and apt to see the controlling number relations in practical situations.

In order to achieve these aims, the first question that arises concerns the organization of the material. The traditional mathematics course has usually been organized with reference to the mathematical principles involved. Problems were selected to illustrate such principles as were considered important, with little or no reference to the value of the problems themselves or their relation to the lives of the pupils. Instead of following the traditional method, this course has been organized on the assumption that the best way to secure a working knowledge of arithmetic is to follow the order determined by the content of the problems. Accordingly, problems that have to do with sewing are grouped together, whether they involve fractions, or percentage, or

decimals. The problems selected are those that naturally find their place in the upkeep and maintenance of the kind of homes that have been described, problems in reading gas meters, in marketing, budget-making, planning meals, etc. Corresponding to the five divisions in the family budget—food, shelter, clothing, operation, and advancement, or higher life—there might be five main divisions in the course, preceded by an introductory section devoted to the study of the principles of budget-making and the keeping of accounts.

The selection of problems to be included in each section has been made in accordance with the following criteria:

1. The subject-matter must represent a real problem within the immediate experience of the girl.
2. The arithmetical solution must also be the practical solution, i.e., the solution used in everyday life.
3. The problem must be of relatively frequent occurrence, of relatively permanent significance, and of relatively wide or general applicability.
4. The technical difficulties or the complexity or the sociological significance of the subject-matter must not be so great as to overshadow the arithmetic.

A brief analysis will serve to show how these criteria have operated in determining the selection of the problems and the scope of the course.

In the first or introductory section are included problems in budget-making and the keeping of accounts. Standard budgets stated both in percentage and in dollars are analyzed and used as guides in the application of budget-making to practical situations. The girls make budgets from various kinds of data, such as price-lists, receipts, and accounts. In this way they learn the practical value of records of expenditures, and they are taught to keep, not merely the usual simple cash account which is nothing more than a record of money spent, but also a distributed account which can be used as a guide in budget-making and as a check upon undue expenditure in any division of the budget.

No attempt has been made to teach girls how to make out checks, nor how to keep bank accounts, nor how to keep "double-

entry" accounts of any kind. Important as these problems are, they are not within the immediate experience of twelve- to sixteen-year-old girls, and they must be taken care of elsewhere in the curriculum.

After the economic basis of the course has thus been laid in the study of the budget, the other topics may be taken up in any order that commends itself to the teacher. She may wish to adapt the order of topics to the special interests of the girls, or to the order of topics in some other department. A satisfactory arrangement might be to study first the topics that relate primarily to the home itself, and then those that are concerned with the needs of the persons within the home.

According to this plan, the section on shelter would follow budget-making. The problems which, according to the criteria, may be included in this section involve the upkeep, but not the actual construction, of the house. They include taking measurements for repairs, drawing to scale, reading builders' plans, making estimates for such repairs as laying floors, painting, and papering. In all these problems the actual methods of practical builders are used, not with the purpose of teaching the girls to be contractors, but in order that they may understand how such estimates are made and be able to judge the value of repair work.

It might seem that other problems should be included here, but all problems that involve complexities of technique peculiar to the building trade are omitted, both because they are outside the actual experience of the girls and because they offer too many difficulties in relation to their value.

The next topic, operation, follows naturally after shelter because the problems are concerned with the home itself. There are problems in estimating the cost of mattings and linoleum, in finding the relative cost of gas and electric appliances, such as irons, vacuum cleaners, and the comparative cost per candle-power of different kinds of gas and electric lights. It may be asked why coal and wood are omitted from the study of fuels. This is because the lack of practical standards of measurements, the loss of heat caused by radiation, and other complicating factors make the problems unsuitable for a general course. Problems in the installation

of heating and ventilating systems are outside the immediate experience of the girls, and their technical difficulties are too great in relation to their value. Problems with regard to laundry lack sufficient reliable data. Problems in the purchase of house furnishings are omitted because the arithmetic involved is too simple in comparison with the complex sociological considerations involved.

After the budget divisions of shelter and operation have been completed, the attention shifts to the more personal needs of those within the home. The first of these needs to be considered is that of clothing. Problems connected with clothing include the estimation of the amount of material needed for garments, and also economical methods of purchase. First of all the girls learn not to talk about buying thirteen inches of material, but three-eighths of a yard; not to talk about buying five-sixths of a yard, but three-fourths or seven-eighths. Eighths and quarters are the trade measures, and the girls must learn to use them if they are to achieve any degree of skill in making their arithmetic serviceable in everyday life.

Then the girls learn how to estimate the allowance to be made for tucks and hems; the amount of material needed for ruffles, platings, bias trimmings, and for completed garments. The use of the bias brings in an element of difficulty that demands special consideration. Perhaps it is not necessary to state that a bias line of cutting is the diagonal of a square whose side is the width of the goods. Needless to say, the dressmaker does not find the length of a bias strip by means of square root, but by the practical rule that the bias line of cutting is approximately four-thirds of the width of the goods. Many problems in the use of the bias which are too complicated to admit of a simple arithmetical solution can be solved by means of various practical rules and devices. If, as is frequently the case, the material for trimming costs several dollars a yard, it is obvious that the ability to make accurate estimates may be a matter of more than academic interest even to the young girl whose chief concern in the subject is in its application to her girdles.

Problems with regard to the amount of material required for waists and for gored skirts depend upon the practical judgment

and experience of the dressmaker and are out of place in an arithmetic course.

In many respects the next topic in the course, that of food, is the most important as well as the most complex. Yet neither in the arithmetic nor in the technicalities of the subject-matter are the problems too difficult for young girls. The importance of proper feeding and the relation of food to efficiency are beginning to be understood as never before. Especially during the present crisis even young girls should know, not only the nutritive value of foodstuffs, but their relative cost.

This section begins with the alteration of recipes to serve a larger or a smaller number of persons. The girls learn through practice how to convert fractional parts of a cup to tablespoons, and how to state recipes in convenient household measures.

But in modern food economics the preparation of food for the table is only a small part of the study of food. Scientific feeding involves measuring the nutritive value of food. For this purpose the great calorie has been adopted as a unit of measure, since the three kinds of nutrients—proteins, fats, and carbohydrates—can be measured by their heat- or energy-producing capacity. The 100-calorie portion is used as a convenient unit in dietary planning. The girls are interested to find how much fuel they require per day according to various dietary standards. They learn how to compute the fuel value of foods from the government tables of the chemical composition of foods. They compute the weight of 100-calorie portions of common foods, and they learn to compute the fuel value of their own breakfasts and other simple meals.

But in these days of the high cost of living it is not enough to know how to find the relative value of foods as nourishment unless one also understands the relative cost of foods. The girls must know how to market to advantage in order to buy those foods that yield the greatest amount of nourishment while providing the needed variety. One way of bringing out this aspect of the problem is to study the relative amount of fuel that can be purchased for \$1.00 in various kinds of foods. In this way the possibility of food substitution for the purpose of cheapening dietaries can be made clear. The use of food substitutes will have to be undertaken

by many families during the next few years, and there is every reason why girls should understand how it can be done scientifically.

A convenient way to estimate the cost of menus and dietaries and to make substitutions of cheaper foods is to use the cost per 100 calories as a basis of comparison. If a man needs 3,000 calories per day, and thirty cents is the allowance for food, it is obvious that he cannot get enough to eat unless the average cost of food is one cent or less per 100 calories. Practice in planning meals at a specified cost per day gives the girls some skill in the application of arithmetic to the daily routine of feeding the family on a budget allowance.

After the study of food it might be expected that the course would be continued to include the other topic in the budget—advancement, or higher life. But the problems that would have to be included in this section, such as mortgages, stocks, bonds, and the investment of savings, are obviously outside the experience of twelve- to sixteen-year-old girls, while problems involving the expenditure of money for leisure-time pleasures, for education, travel, music, books, entertainment, and for charity offer such comparatively insignificant arithmetic in contrast to the enormously significant social problems involved that they would better be considered in a social-science course.

The four budget divisions—shelter, operation, clothing, and food—together with a study of budgets and accounts, have thus been made to serve as an outline of the course, and an attempt has been made to select the problems from the everyday experience of the girls in such a way as to broaden their general education and give them skill in the application of arithmetic to practical situations.

The division of the course into separate topics makes it possible to teach each section as a separate unit when or where it is most needed by any group of girls. Another advantage of this method of organization of the subject comes from the fact that it insures frequent repetition of the various processes of arithmetic. All of the important processes are repeated over and over again in a slightly different application, so that the emphasis is placed naturally on those more frequently used from the very fact that they

occur more frequently in the problems. Take the subject of percentage for instance. Introduced first under the division of the income, it appears again when methods of purchase are studied with reference to the percentage of saving or the percentage of waste effected by buying in large or small quantities, by cash or credit, by accurate or inaccurate measures. The actual loss when more material is purchased than can be utilized is viewed, not only as a certain definite money loss, but also as a certain percentage of increase in the cost of the garment. The average increase in the price of commodities in the local stores during a certain period forms a basis for estimating the percentage of increase in the cost of living during the period. In this way the girls learn to use percentage in practical situations, and they acquire the habit of considering, not only actual numerical differences, but also relative differences.

Again, take the subject of graphs. Used at first to illustrate the different amounts to be allowed for each division of the budget, the graph appears merely as a new way of representing numbers, more or less interesting because of its novelty. But as the graphic method is used over and over again in each section of the course to represent many different kinds of relations and comparisons, it begins to assume increasing importance, until the girls realize what a valuable tool it may be in bringing out the relative importance of facts whose significance is sometimes lost when stated in abstract numbers.

The actual arithmetic used in the problems may be briefly summarized as follows: common fractions, usually quarters, halves, thirds, and sixths; decimal fractions and approximations; aliquot parts of 100; percentage; proportion; and graphs. It is assumed that the girls have already studied these processes in the elementary school, and that they are ready to acquire skill in their application to practical problems.

One other matter remains to be considered—the teacher. In what department should such a course be taught? Can a teacher of mathematics be expected to understand the subject-matter sufficiently well to teach problems in scientific dietetics, in sewing, and in budget-making? Or can a teacher of household arts be

expected to understand methods of teaching mathematics well enough to do this work effectively? Perhaps these questions will have to be answered differently in different schools. One thing, at least, is certain—the course should be taught by someone who is in sympathy with its purpose and who is sufficiently well informed to make the problems serve the ends for which they have been selected. It would be a pity to have the teaching done by a person who was so absorbed in the subject-matter that she failed to utilize the opportunity to develop skill in the use of arithmetic; on the other hand, it would be almost worse to have the teaching done by a mathematician who had no interest save in the mere number relations, and who cared only for correct results with little or no regard for the sociological implications of the subject-matter.